

*Recd Aug 4/13*

**JOINT REPORT**  
**ON**  
**COMPREHENSIVE SYSTEM OF**  
**PASSENGER SUBWAYS**  
**FOR THE**  
**CITY OF CHICAGO**  
**BY THE**  
**HARBOR AND SUBWAY COMMISSION**  
**AND**  
**SUB-COMMITTEE OF THE COUNCIL**  
**COMMITTEE ON LOCAL TRANSPORTATION**

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**SEPTEMBER 10, 1912**



1. General Outlines
2. The Financial Plan
3. Engineering Features
4. Routes Recommended

BARNARD & MILLER PRINT CHICAGO



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Chicago, September 10, 1912.

To the Honorable,  
The Committee on Local Transportation,  
City Council, Chicago.

GENTLEMEN :

The undersigned, members of the Harbor and Subway Commission, in conjunction with the undersigned members of a sub-committee of your honorable body, beg leave to submit, in accordance with instructions contained in a council order, dated July 15, 1912, tentative routes for a comprehensive system of municipal passenger subways in the City of Chicago.

On February 19, 1912, under specific instructions from your honorable body, with the Mayor's approval, this Commission submitted tentative routes for an independent system of municipal subways extending to the city limits on three sides.

Since the date of the last mentioned report, it having become apparent that any system of passenger subways for Chicago, to be successfully built and maintained, should be so designed and executed as to cover the whole transportation field within the city limits, your honorable body has requested from this Commission more comprehensive plans for municipal subways which will be entirely independent of, and supplementary to, all existing means of transportation. On July 15, 1912, the City Council unanimously concurred in your Committee's recommendation that, "The Chicago Harbor and Subway Commission be instructed to present to this Committee a comprehensive scheme of subways which shall extend into the outlying districts, and which shall be designed to remedy the existing traction evils of the City of Chicago."

Pursuant to these instructions, and after frequent consultations between this Commission and your sub-committee, we herewith make specific recommendations on the selection of routes for a comprehensive municipal subway system, as being, in our judgment, the most practical and efficient means of bringing Chicago's transportation facilities up to a standard imperatively demanded by the city's growth.

#### PRESENT AND FUTURE NEEDS.

In laying out a comprehensive plan of rapid transit subways in Chicago, it must be borne in mind that traffic demands are constantly increasing with the growth of population. The average number of rides per capita, on local transportation lines, increases with the growth of every city. Within ten

years the average number of rides per capita in Chicago has increased from 200 to 300, without counting suburban traffic on steam or electric roads. Assuming that population will increase in Chicago, in the same ratio as in the past, it is obvious that a comprehensive system of municipal subways is needed to care for entirely new traffic, besides relieving present congestion.

Your sub-committee, in company with a member of the Harbor and Subway Commission, visited New York, Philadelphia and Boston several weeks ago, and made personal inspection of the more recent developments in municipal transportation in those cities. In New York, particularly, the actual operation of modern passenger subways was observed by your sub-committee, and the modern system of financing and conducting those great utilities investigated.

It may be briefly stated that, in its financial aspects, the scheme of a comprehensive municipal subway system for Chicago has been worked out on the proved theory, based on New York's experience, that the capital cost of constructing Chicago's municipal subways can be provided for in full out of future earnings, and that no part of such capital cost need form an additional ultimate charge upon Chicago's taxpayers.

The subway routes herewith submitted are on a basis of absolute municipal ownership and control, for all time, of the leading arteries of transportation within the city limits. They are laid out to provide real rapid transit on trunk lines, with such through route connections and outlying extensions as will weld the three divisions of Chicago into a compact whole. These initial subways are designed to permit of practically unlimited future expansion.

### BASIS OF SUBWAY ROUTING.

The initial subway routes, as herewith recommended by the Harbor and Subway Commission, in conjunction with your sub-committee, have been laid out on the theory that many feeders and extensions, to be built under the same limitations of municipal ownership and control, will become necessary in the not distant future. The initial routes are on the trunk line principle, and are intended to not only relieve immediate traffic congestion but to furnish subway arteries with capacity for handling the traffic from such feeders as the city may provide in future as an integral part of the municipal subway system.

The routes herewith recommended for the construction of the first passenger subways in Chicago have been laid out as



offering the simplest and most direct method of furnishing adequate transportation facilities on the lines of established travel—that is, they are laid out to be built on thoroughfares that are natural arteries of communication between thick groups of population. This, in the first place, insures the relief of traffic congestion. It also shortens the period in which the profits from subway operation will be required to pay the capital cost. Finally, it will accelerate the growth and business prosperity of those sections of the city now suffering from poor transportation facilities.

Your sub-committee, in making recent investigations as to present and planned subway operations in the City of New York, was supplied with facts and figures showing the marked beneficial effect of such subway operations upon real estate values and upon commercial interests generally. Applying the same principle to Chicago, it has been this Commission's policy, in co-operation with your sub-committee, to map out a system of rapid transit subways that will provide a basis for future city expansion, and for the growth and added prosperity of the city at large. This is particularly true as to outlying sections where the need of adequate rapid transit has seriously retarded commercial and residential growth.

During the discussions over the location of subway routes, it was early apparent that the limitations of initial subway construction were self-evident—that is, that the clamor of particular residence or business sections for subway routes could not be allowed to influence the judgment of this Commission, nor of your sub-committee, as to the first necessity of locating subways where they will accommodate the greatest number of daily patrons, and where their construction will obviously tend toward a greater inter-communication between the three natural divisions of the City of Chicago.

### “ONE CITY—ONE FARE.”

In Chicago, as in New York, it will doubtless be found possible to build a comprehensive passenger subway system, and make future additions thereto as traffic warrants, on the “one city one fare” principle—that is, it will be the aim from the start, to adopt the principle of universal carriage or transfer, to or from anywhere within the city limits, in a continuous ride, for a single five cent fare. All the new subway contracts in New York are based on a universal five cent fare, and all the financial problems of construction, maintenance, operation, amortization of capital debt, and division of surplus profits, are worked out on a five cent fare basis.

Applying the same "one city one fare" principle to Chicago, it is evident that a single five cent fare, with transfer privileges to or from connecting lines, will be the speediest method of wiping out the artificial barriers between the three geographical divisions of Chicago, and making the city a compact whole by the interlacing of transportation lines on the principle of rapid transit through routes with local feeders. It is self-evident that such local feeders can be provided by the municipality, if necessary, as well as trunk line construction.

### SERVICE THE MAIN ISSUE.

This Commission and your sub-committee have, moreover, endeavored as far as possible to avoid the theory, so universal in laying out privately owned transportation lines, that Chicago's new rapid transit subways should be built only where they will yield an immediate profit from operation. While the possibility of profitable operation has had due weight in each case, we have sought to serve the best interests of all the people of Chicago by mapping out a subway system that will penetrate to all sections of the city at the same time, and will in this way tend toward the symmetrical building up of all sections that will thus obtain the benefits of genuine rapid transit. We have acted on the well-established principle, whenever better transportation becomes a municipal undertaking, that it is the province of transportation improvements to equalize the prosperity of localities, in so far as a comprehensive planning of subway routes can do. It is obvious that a municipally-owned subway system can afford to support, for a time, the less profitable extensions out of the surplus earnings of those routes that extend through richer and more populous territory.

We wish further to call your honorable body's attention to the avoidance of construction complications in the subway routes herewith outlined. It has been taken for granted that what Chicago needs, at this stage, is the simplest, as well as the best plan of construction that will obviate expensive and impracticable "double-decking" or switches and turnouts. The construction plans are so designed that the least expensive methods of operation may be at the same time the most effective method of furnishing rapid transit. It will be possible, in the system herewith outlined, to keep subway operating expenses at a minimum while maintaining the highest possible degree of efficiency and safety in the operation of subway trains.

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## THE FINANCIAL PLAN.

It is not within the Harbor and Subway Commission's province to make recommendations as to the financing of these initial municipal subways, but there are obvious points that, as engineers, with the concurrence of the sub-committee, it becomes our duty to make clear to your honorable body, and to the City Council. For instance:

It is possible to give the largest physical subway capacity, at the cheapest cost, by a policy of construction on an independent basis, and there is the additional advantage of absolute municipal control, from the outset, not only during the construction period but during the period of operation and management by whatever agency the city may elect to designate.

In the alternative plans that have been suggested for financing Chicago's municipal subways, the principle of retiring capital indebtedness by the sinking fund method is so obvious in either case that it becomes merely a question whether the issuance of bonds, to defray the cost of subways, shall be done by the municipality direct or by private construction agencies that shall enter into a contract with the municipality that will give the latter the privilege of "recapture" and absolute municipal ownership in the end.

### DIRECT BONDING BY CITY.

As to the suggested method of building Chicago's municipal subways out of the proceeds of legalized Mueller certificates, in an opinion dated July 11, 1910, by the Corporation Counsel to the City Council, the former states:

"The city has the power to issue bonds for the construction and equipment of subways, provided that said bonds are a lien upon such property and income only, and are not included in the bonded debt of the city.

"The city has the right exclusively to pledge and pay the traction fund as interest upon such bond issue and to use any portion of such fund for the purpose of funding such bonds.

"The city has the right further to use any net revenue received, either from the operation or the leasing of such subways when constructed, for the purpose of retiring such bonds."

### ENLISTMENT OF PRIVATE CAPITAL.

The alternative method of successfully financing the construction of Chicago's municipal subways will be found by

drawing up plans and specifications for a definite group of initial subways, and inviting competitive bids from private capital for the construction of such subways, under such limitations as will not only insure absolute municipal ownership of the properties, but will give absolute municipal control during the period of construction and operation pending the final extinction of the capital debt.

The Harbor and Subway Commission, in conjunction with your sub-committee, has further taken for granted that such competitive bids are only possible after the laying out of definite routes for initial subways, and the drawing up of plans and specifications based on such selection of routes.

### ALTERNATIVE BIDS DESIRABLE.

Thus it is apparent that when these initial routes have been approved by your honorable body, and ratified by the City Council, this Commission will be in a position to proceed with plans and specifications for alternative bids, if the latter course is deemed advisable, as follows:

1. Bids for the construction of a comprehensive system of independent municipal subways, or any part thereof, as specified by the City Council.
2. Bids for the construction of such municipal subways and the operation of such municipal subways as rapidly as they are made available for operation.
3. Bids for the operation of such municipal subways when other construction agencies have made them available for operation.

In our judgment, the separation of contract bids, when plans and specifications for Chicago's municipal subways are complete, into (1) Construction, (2) Construction, maintenance and operation, (3) Maintenance and operation, has the advantage of permitting closer municipal control and supervision over every detail in the proposed contracts. It permits specially expert construction agencies, or specially expert operating agencies, to make separate bids. It also enables the realization of a practically immediate start in subway construction, leaving the question of maintenance and operation of the subways, when built, to separate methods of adjudication by the City Council, with referendum approval by the citizens of Chicago.

### SINKING FUND NECESSARY.

In general terms, it may be set down as a fixed principle, based on New York's experience, that the financing of an independent system of municipal subways should only be

undertaken on such terms as will automatically wipe out the capital cost of such subways, in a given term of years, on a sinking fund basis, and will make certain that at the end of such term of years the entire subway plants shall become the property of the people of Chicago free of all debt.

Reliable actuarial authorities agree that a sinking fund, regularly compounded, will retire any bonded indebtedness in full after the lapse of as many years as are considered a prudent "spread" of the liability. It is thus apparent that any financial contract that may be entered into for the construction of Chicago's municipal subways has only to carry the provision for a sinking fund, to be paid out of gross receipts, to insure the amortization of the capital debt of the properties within a limited term of years. It is further apparent that at least a portion of the cost of Chicago's municipal subways should be borne by the future generation of Chicagoans that will reap the benefits of the present day construction.

It is immaterial, in a financial sense, whether the gradual amortization of bonded indebtedness on Chicago's municipal subways shall extend beyond the life of a subway franchise, or even beyond the life of a company that may be chartered to either build or operate subways. The terms of any contracts that may be entered into between the City of Chicago and subway construction agencies need not provide that at the expiration of such contract the whole capital debt on the properties must be discharged. It is sufficient that the lien on the properties shall be constantly reduced until finally extinguished, on a sinking fund basis, independently of all questions of ownership or control of the properties.

### POOLING PROFITS TO REDUCE DEBT.

If a contract is entered into between the City of Chicago and an operating company, it is our unanimous judgment that there should be no division of surplus profits from subway operation, after necessary fixed charges have been provided for, until regular payments into a sinking fund have also been provided for. The working out of this sinking fund lien on gross receipts, should be absolute and cumulative, the same as other fixed charges, so that in the event of a period of deficiency in operating any part or all of Chicago's municipal subway system the future surplus profits, when the lines are profitable, shall be required to bear their proportion of outlay in making up these prior deficiencies.

The precedents for working out a financial plan, in thus providing means for building Chicago's municipal subways,

are amply outlined in the contracts referred to above as having been executed between the municipality of New York and subway construction agencies, with the approval of the Public Service Commission and of the courts.

### NEW YORK'S FINANCIAL METHOD.

In general terms, it has been found possible for the municipality of New York to enter into contracts for the expansion of its present passenger subway system, the estimated cost of which will exceed \$250,000,000, by furnishing about one-half the construction capital on municipal credit, the companies furnishing the remaining one-half. These contracts further provide that the City will assume absolute control of the new subways now to be built, and of all future extensions; reserving the right also, after a period of ten years, to "recapture" any or all of these new subway lines "for combination in an independently operated or municipally operated system, whenever the taking of either course may seem wise."

### BETTER TERMS POSSIBLE HERE.

It is our belief that while these New York contracts furnish, in the main, a safe guide in drawing up contracts for the construction and operation of Chicago's municipal subways, it is more than probable that even better terms may be obtained by this municipality through the system of competitive bids already outlined.

The new contracts entered into by the City of New York with two private corporations, for subway extensions, include the maintenance, equipment and operation of these new subways, as well as their construction. The title to all new subways, covered by the contracts, is vested in the municipality, whether said lines are constructed by the City or by the operating company, or by division of cost between the two. In general, the term of the leases is fixed at forty-nine years from the beginning of operation, but the City retains the right to take over any or all of the new subways after ten years of operation by making specific payments to reimburse the operating company for its share of the investment. It is proposed to pool all subway earnings, while the operating leases are in force, and to make equitable division thereof between the City and operating company, after full provision for operating expenses, interest, sinking fund and other fixed charges, is made.

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## ENGINEERING FEATURES.

### *General Construction.*

A high level subway, located as close as possible to the surface of the streets, has been aimed at throughout. Grade crossings will be entirely avoided. The only deviation from the high level principle will be where subways intersect, and at river crossings.

This system will decrease the cost and increase the efficiency of subways and approaches nearer to the ideal of subway transportation than would low level construction.

### *Ventilation.*

To effect proper ventilation, it is proposed to take advantage of the piston action of the trains, each track being enclosed except at stations. A sufficient number of openings through the roofs and sides of the subway will be provided, so that the circulation of the air produced by the moving trains will satisfactorily expel the vitiated air from the subway and stations.

This method will be supplemented by the action of centrifugal fans placed in chambers midway between stations so that in case of excessive heat or other abnormal conditions the fans can be thrown into operation.

The location of fans is such that fresh air will be drawn into the subway through the roof, side openings and portals, and through the passage ways at stations and finally exhausted into the outer air at the fan chambers.

The fans will have capacity sufficient to provide positive and rapid ventilation in case a train should become stalled, or, in the event of fire, to force the quick removal of smoke.

### *Utilities.*

The permanent provision for municipally owned utilities is under joint consideration with the heads of City departments affected, but no definite plans can be prepared until subway routes are determined.

In some cases it may be advisable to construct a compartment for this service, but generally the utilities may be diverted or placed in sub-surface space not required for subway use.

Conferences with public service corporations indicate a preference upon their part to move to other territory and to



build and maintain their own conduits, rather than to pay their proportion of the cost of a compartment in the subway.

In Boston and New York no provision has been made in their subways for either municipal or private utilities.

The utilities were either put in the sides of the streets, or under the surface of the streets over the subways or else, as was done in many cases, were diverted to the adjoining streets.

#### ESTIMATED COST OF SUBWAYS.

North Side to Lawrence Avenue.....	\$20,123,000
South Side to 79th Street.....	25,778,000
West Side to 40th Avenue.....	31,049,000
Halsted Street .....	19,307,000
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	\$96,257,000
Estimated cost of equipment.....	34,844,000

The equipment will be furnished by the Operating Company.

The estimates of cost of construction submitted in this report cover all necessary excavation, and concrete, brick and steel construction, the bracing of excavations, maintenance of limited or controlled traffic in one-half the width of the streets within a distance of three miles from the intersection of State and Madison streets, the shoring and bracing necessary to maintain the level of buildings and the restoration of street paving and surface track construction, also temporary construction to maintain sewer and water service and fire protection during the time of partial obstruction of the street.

In the territory over three miles from the intersection of State and Madison streets it is expected that traffic may be diverted to other streets and alleys during the period of subway construction.

#### POWER SYSTEM.

The power system, contemplated for subways, comprises alternating current generation and distribution, and direct current operation of car motors. In other words, power will be distributed from the central station at high potential to sub-stations, located as near as possible to center of demand, where this power will be transformed and converted into direct current at potential of 625 volts. Estimates were based on third rail direct current system of conductors.

The generator plant, as well as the electrical distribution system, which consists of all cables between the central power station and sub-stations, was estimated of sufficient size and capacity to take care of all probable initial traffic demands. Provisions were also made for ample future extension in all departments. All cables between the central power house and sub-stations to be placed in underground conduits and, when such cables parallel the subway structure, such conduits to be built in as a part of the tunnel walls.

## ROLLING STOCK.

The type of car contemplated for use to be of steel construction with enclosed vestibules and sliding doors, with an approximate seating capacity of 60 passengers. The windows to be so arranged that air circulation will be obtained without drafts on passengers.

High power motors to be used on cars to obtain high schedule speed with frequent stops, thus permitting maximum carrying capacity of the subway, as well as obtaining maximum strength with the smallest permissible weight. The multiple unit system of electrical control to be used on all trains. All cars to be heated and lighted by electricity, the wiring for heaters and lights to be so safe-guarded as to avoid all risks of short circuit or fire.

## SIGNAL SYSTEM.

A complete system of automatic block signaling and interlocking adapted for efficient spacing and directing of trains is contemplated. The efficiency of operation of the road, with such heavy traffic as contemplated, depends largely upon the signaling and interlocking system installed. The prime considerations given were safety, reliability and maximum capacity of the line.

## TRAFFIC.

With the type of equipment and the schedule speed contemplated, the following tabulation indicates the time that will be required for a given subway train to traverse the distance between its outer terminal and a point in the center of the city, approximately State and Madison streets.

Terminal	Route.	No. of Station Stops.	Length of Subway.	Number of Tracks.	Time for Express Trains.	Time for Local Trains.
			Miles.			
Lawrence Ave.	Evanston Halsted Clark	13	3.1	2	18.7 min.	21.8 min.
Lawrence Ave.	Lincoln Clark	14	3.42 3.6	4 2	20.4 min.	23.5 min.
Kedzie Ave.	Elston Ave. California Ave. Milwaukee Ave.	16	2.5 5.25	2 2		26.3 min.
40th Ave.	Armitage Ave. Milwaukee Ave.	15	1.8	2		24.0 min.
40th Ave.	Madison St.	10	4.8	2		16.3 min.
40th Ave.	26th St. 22nd St. Blue Island Ave. Harrison St.	14	6.8	2		23.0 min.
Western Ave.	55th St. So. State St.	20	3.0 6.0	2 4	25.7 min.	31.4 min.
79th St.	Cottage Grove 55th St. So. State St.	22	4.15	2	29.3 min.	34.9 min.
From Fullerton Ave. to 79th St.	Halsted St.	24	12.0	2		40.2 min.
Total			56.42			

### *Estimated Capacity.*

The capacity of the subway system outlined in this report is estimated to be 180,000 seats per hour.

## ROUTES AS RECOMMENDED.

### *North Side to South Side.*

Beginning at Lawrence and Evanston avenues a two track subway in Evanston avenue to Irving Park boulevard and Halsted street; south in Halsted street to Fullerton avenue.

Beginning at Lawrence and Lincoln avenues a two track subway in Lincoln avenue to Halsted street and Fullerton avenue.

The two subways from the north joining at Halsted street and Fullerton avenue are continued as a four track subway

southeast in Lincoln avenue to Clark street; south in Clark street to some point just north of the river, (subject to further engineering investigation). Thence a two track subway for express trains south in Clark street to Polk street or some street further south; east in Polk street or some other street to State street; south in State street in a four track subway to 55th street. A two track subway east in 55th street to Cottage Grove avenue; south in Cottage Grove avenue to 79th street. Transfers can be made from this subway at Fullerton avenue to the Halsted street subway; at Clark and Madison streets to the Madison street subway; at Harrison and Clark streets to the southwest subway.

### ***North Side to Southwest Side.***

Two of the four tracks from the North Clark street subway continue in a two track subway east from Clark street to State street; thence south in State street to Harrison street; west in a two track subway in Harrison street to Halsted street and Blue Island avenue; thence continuing southwest in Blue Island avenue to 22nd street and Ashland avenue; west in 22nd street to Marshall boulevard; south in Marshall boulevard to 26th street; west in 26th street to South 40th avenue. Transfers can be made from the subway at Fullerton avenue to the Halsted street subway, at State street to the "Northwest Side to South Side" subways. At Halsted and Harrison streets to Halsted street subway.

### ***Northwest Side to South Side.***

Beginning at Elston and Kedzie avenues, a two track subway in Elston avenue southeast to Belmont and California avenues; south in California avenue to Milwaukee avenue; southeast in Milwaukee avenue to Desplaines or Canal street.

Continuing south in Desplaines or Canal street to Randolph street; east in Randolph street to State street; south in State street in the four track subway to 55th street and State street; thence west in 55th street in a two track subway to Western avenue. Transfers can be made from the subway at Milwaukee avenue and Halsted street to the Halsted street subway; at State street to the "North Side to Southwest Side" subway; at 55th street and Halsted street to Halsted street subway.

A two track subway in Armitage avenue from North 40th avenue to Milwaukee avenue, connecting with the Elston-Milwaukee avenue line.

***Halsted Street.***

Beginning at the junction of the Lincoln and Evanston avenue lines at Fullerton avenue a two track subway in Halsted street to 79th street. Transfers can be made from this subway at Fullerton avenue to the "North Side to South Side" and the "North Side to Southwest Side" subways; at Milwaukee avenue to the "Northwest Side to South Side" subway; at Harrison street to the "North Side to Southwest Side" subway; at 55th street to the "Northwest Side to South Side" subway.

***Madison Street.***

Beginning at South Clark street, a two track subway in Madison street to 40th avenue. Transfers can be made from the subway at Halsted street to the Halsted street subway; at Madison and Clark streets to the "North Side to South Side" subway. This subway may eventually be extended south in Clark street and other streets to serve the southwestern part of the city.

Respectfully submitted,

(Signed) JOHN ERICSON,

(Signed) JAMES J. REYNOLDS,

(Signed) E. C. SHANKLAND,

*Commissioners.*

(Signed) WILLIAM J. SHANKS,

*Secretary.*

(Signed) EUGENE BLOCK,

*Chairman,*

(Signed) JOHN A. RICHERT,

(Signed) PATRICK J. CARR,

(Signed) WILLIAM F. SCHULTZ,

(Signed) WILLIAM J. HEALY,

(Signed) HENRY D. CAPITAIN,

(Signed) CHAS. TWIGG,

*Sub-Committee of Committee  
on Local Transportation.*

(Signed) H. H. EVANS,

*Secretary to Sub-Committee.*



PROPOSED ROUTES  
FOR  
**COMPREHENSIVE SYSTEM  
OF  
PASSENGER SUBWAYS**  
FOR THE  
**CITY OF CHICAGO**

SCALE: ONE INCH REPRESENTS ONE MILE  
AND  
ONE FOOT REPRESENTS ONE HUNDRED FEET

BASED ON SUBWAY COMMISSION  
REPORT NO. 192

PROPOSED ROUTES: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.







